



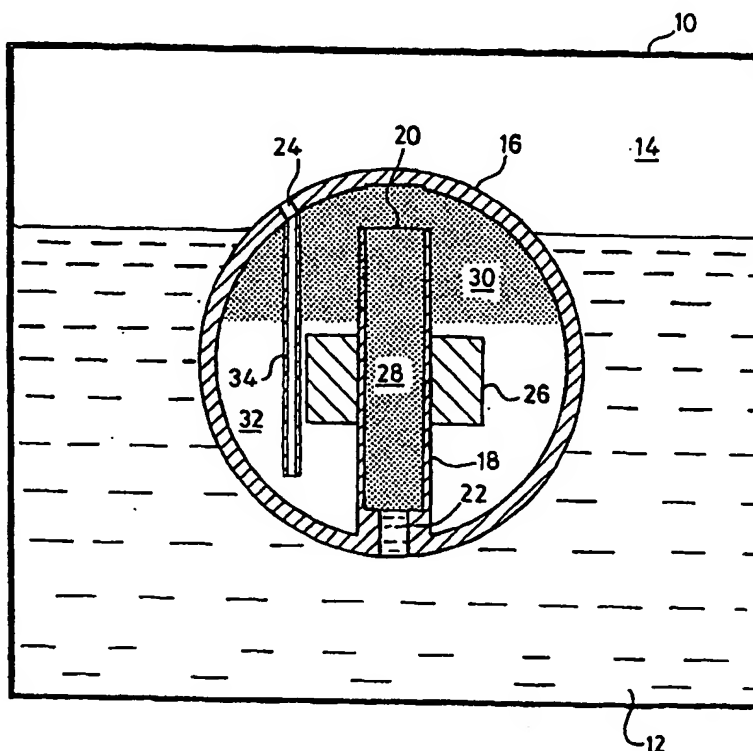
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B65D 79/00		A2	(11) International Publication Number: WO 95/03982
			(43) International Publication Date: 9 February 1995 (09.02.95)
(21) International Application Number: PCT/GB94/01658 (22) International Filing Date: 1 August 1994 (01.08.94) (30) Priority Data: 9315830.1 30 July 1993 (30.07.93) GB (71) Applicant (for all designated States except US): PA CONSULTING SERVICES LIMITED [GB/GB]; 123 Buckingham Palace Road, London SW1W 9SR (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): HOUZEGO, Peter, John [GB/GB]; 8 The Drift, Oakington, Cambridge CB4 5AD (GB). WOOD, Timothy, Michael [GB/GB]; 6 The Lawns, Melbourn, Royston, Hertfordshire SG8 6BA (GB). COX, Peter, Erich [GB/GB]; 1 March Lane, Cherry Hinton, Cambridge CB1 3LF (GB). (74) Agent: NASH, Keith, Wilfrid; Keith W. Nash & Co., Pearl Assurance House, 90-92 Regent Street, Cambridge CB2 1DP (GB).		(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, GE, HU, JP, KG, KP, KR, KZ, LK, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>Without international search report and to be republished upon receipt of that report.</i>	

(54) Title: DEVICE FOR PRODUCING A HEAD ON A BEVERAGE

(57) Abstract

A device for generating a head on a liquid in a sealed and pressurized can, when the can is opened, comprising a hollow capsule (16) which initially floats on the liquid so that apertures (22, 24) in the capsule are initially disposed one above and one below the liquid level surface, liquid being drawn up into the container through the immersed aperture by an absorbent wick (28, 30) combining with ballast means (26) eventually to cause the capsule to at least partially invert and trap gas under pressure within the capsule, ready for release when the can is opened to issue through a small aperture as a fine jet into the liquid and bubble to the liquid surface.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

DEVICE FOR PRODUCING A HEAD ON A BEVERAGE

Field of invention

This invention concerns devices for assisting in the production of a so-called head when packaged beverage, especially alcoholic beverage and particularly beer, stout, ale, lager and lager-beer, is poured from the package. Such devices will be referred to herein as head generating devices.

Background to the invention

Head generating devices for use with sealed containers such as cans generally comprise small capsules of gas retained at or above internal container pressure. The capsule is usually retained near the base of the container. The action of opening the latter causes the in-container pressure to drop to atmospheric thus allowing gas to escape from the capsule into the beverage so creating a head on the beverage.

Conventional devices although effective are difficult to insert into container and are generally sensitive to the tolerances of the plastics moulding and container manufacture. The result is that filling line capacity is often significantly reduced and container costs can be higher due to the tighter tolerance range necessary. Furthermore such devices must be held tightly in the container so as to remain in position despite their inherent buoyancy to allow charging with gas when the container is inverted and discharging gas from the bottom of the container on opening. This imposes restrictions upon capsule design, container type and tolerance, filling line speed of operation, washing, prefilling and assembly automation.

Clearly if such devices can be designed which do not have to be

constrained to remain in a particular position within a can or other container, many of the above problems will be eliminated.

Object of the invention

It is one object of the present invention to provide a head generating device for entrapping a volume of gas under pressure in a sealed container partly filled with beverage under pressure, which is more suited to mechanical handling thereby simplifying insertion into the container.

It is another object of the invention to provide such a device which can be charged with gas under pressure from the headspace gas in the container without the need to invert the container to bring the capsule into the headspace.

It is a further object of the invention to provide such a device which does not need to be secured in position in a container.

It is a still further object of the invention to provide such a device which does not need to be inserted into a container in any particular orientation.

Summary of the invention

According to one aspect of the present invention a head generating device comprises a substantially hollow capsule having a first aperture, a second aperture remote from the first aperture, ballast means within the device selected as regards mass and position therein such that the capsule will float in a liquid with the first aperture above the liquid surface and the other immersed, wherein liquid can enter the capsule through the immersed aperture, the mass of liquid entering the capsule combining with the ballast to cause the capsule to rotate at least to the extent that the respective conditions of the two apertures are reversed and the interior of the capsule forming

with the liquid therein a liquid lock when the latter is rotated to inhibit the further ingress of liquid and trap a volume of gas therein, and wherein a head device for generating a head on a beverage in a sealed container, when the container is opened, comprising a substantially hollow capsule having a first aperture, a second aperture remote from the first aperture, ballast means within the device selected as regards mass and position therein such that the capsule will float in a liquid with the first aperture above the liquid surface and the other immersed, wherein liquid can enter the capsule through the immersed aperture, the mass of liquid entering the capsule combining with the ballast to cause the capsule to rotate at least to the extent that the respective conditions of the two apertures are reversed and the interior of the capsule forming with the liquid therein a liquid lock when the latter is rotated to inhibit the further ingress of liquid and trap a volume of gas therein, and wherein the capsule contains absorbent material forming a wick which draws liquid up when the capsule is floating in liquid so as to alter the position of the centre of gravity of the capsule and cause the latter to assume a position of unstable equilibrium from which the capsule is readily rotatable so as to reverse the condition of the two apertures.

If such a device is located within a sealed and pressurised container which is partially filled with liquid, the interior of the capsule will be pressurised by the gas in the headspace above the liquid to the same elevated pressure as that of the headspace. After it at least partially inverts, the trapped gas remains at the elevated pressure and is available to exit from the capsule when the container is opened and the pressure in the container drops.

Where the liquid contains dissolved gas such as nitrogen and carbon dioxide and the issuing gas has to pass through the liquid before it can escape to atmosphere, the issuing gas can be arranged to initiate an avalanche effect on the dissolved gases and create a head of fine bubbles on the liquid.

Generally it is necessary for the issuing gas to be in the form of a fine jet to achieve significant head production to which end the size of the aperture through which the gas is to issue into the liquid is selected so as to create such a desired jet.

Valve means may be provided to create the said liquid lock and prevent gas from escaping except through the jet producing aperture.

The valve means may be operated for example by inversion of the capsule or by a timing device or by a temperature sensitive device or by a magnetic field or by relative movement between a flotation member and the capsule wall, or by the entry of liquid into the capsule and the movement of a diaphragm or expansible member thereby within the capsule.

The ballast means may be fixed in position within the capsule or may be upwardly movable therein as a consequence of the ingress of liquid to which end the ballast means may be a buoyant member which rises with the rising level of liquid within the capsule so as to raise the centre of gravity of the capsule and create an unstable condition and cause the capsule to invert into a position of stability.

According to a preferred feature of the invention the second aperture communicates with the interior of the capsule by means of an elongate open ended tube which extends across the capsule to a position therein which is close to but spaced from a region of the inside surface of the capsule which is diametrically opposite the position of the said second aperture, and the said first aperture is situated in a region of the capsule wall which is close to but not aligned with the open end of the said elongate tube.

The tube is preferably packed with the absorbent material which draws liquid up into the tube when the capsule is floating in liquid. The absorbent wick is preferably of a mushroom shape

having its head immediately beyond the open end of the tube.

Preferably the first aperture communicates directly with the interior of the capsule and is not impeded by the liquid absorbent material therein.

According to a preferred feature of the invention, a pipe or tube extends from the said first aperture internally of the capsule generally parallel to the first mentioned tube or pipe extending from the said second aperture, the length of the tube or pipe associated with the said first aperture being selected so that when the capsule is inverted and the said first aperture is on the underside of the capsule, the other end of the pipe or tube communicating with the said first aperture is situated in a region of the capsule which contains gas and is above the level of any liquid contained in the capsule as a result of ingress of liquid during the priming step when liquid is drawn into the capsule by means of the wick.

Typically the size of the first aperture is in the range 150-300 microns diameter.

Typically the ballast comprises an annular weight fitted around the first mentioned pipe or tube which extends from the said second aperture into the capsule and is positioned therealong just below the centre of area and having a mass which is such that the capsule will settle with the small first aperture positioned just above the surface of the liquid.

When initially deposited into liquid such as beer in a container which is partially filled with beer and is thereafter sealed so that the headspace above the beer can be pressurised, the capsule will initially float allowing pressure equalisation to occur as nitrogen and Carbon dioxide pressure is built up within the container as can happen during a pasteurisation process when the temperature of a can is raised. The capsule will remain buoyant for a period of time determined by the capillary properties of

the wick material. The wick continues to absorb liquid and as this occurs the buoyancy of the device will change until such time as the capsule is no longer buoyant and sinks. Liquid will continue to be absorbed, further changing the buoyancy of the device until the centre of mass moved above the centre of area (since the absorbing material above the pipe is located only in the upper region of the capsule. As the centre of mass shift occurs, the device will turn until the small hole originally at the top of the capsule is now positioned at the bottom. Thereafter the device will remain in this orientation, whatever the orientation of the container, thus preventing any significant further ingress of liquid and preserving the pressure of the internal volume of gas trapped in the capsule.

Upon opening the container, depressurisation occurs thus causing gas inside the capsule to vent rapidly into the liquid through the small lower hole. Where the liquid is a beer or other beverage containing dissolved gases, the venting liquid will cause gas to come out of solution and create a mass of bubbles to rise to the surface and create a head. The significant restriction imposed by the saturated wick will prevent any significant quantity of liquid or gas to exit through the secondary hole at the top of the pipe.

A particular advantage of a device such as described is that by appropriate selection of position and/or direction of jet, the exiting gas from the capsule can cause the latter to rotate within the container thus expelling of gas around the whole of the cross-sectional area of the liquid in the container improving the overall head production performance.

The device does not have to sink to the bottom but can be made to work as a non-sinking device remaining on the surface at all times but inverting after the liquid has been drawn into the wick. The function is similar to the sinking device previously described.

In another arrangement one way valves are located in the apertures in the capsule and the capsule is weighted to float in a particular orientation with the upper one way valve mechanism allowing flow of gas from the headspace into the device and the lower valve permitting positive pressure inside the device to vent through the submerged hole.

A preferred shape of capsule is spherical, but cylindrical, rectilinear- trapezoidal, hemispherical and other shapes may be utilised. Clearly the shape of the capsule may affect its stability when floating and enable a more bistable type of operation as between one orientation and the other as compared with the gentle rotation which would normally be associated with a cylindrical or spherical device.

According to another aspect of the present invention there is provided a container partially filled with a liquid having gas dissolved therein and a headspace above the liquid containing gas at a pressure greater than atmospheric, and located within the said container a head generating device as aforesaid, so that when the end of the container adjacent the headspace is broached as by severing a weakened tab region and the headspace pressure is relieved to atmosphere the trapped high pressure gas within the capsule will be jetted into the liquid to assist in the generation of an upward avalanche of small bubbles to form a head on the surface of the liquid when the latter is poured into a glass or other drinking vessel.

According to another aspect of the present invention a method of trapping a volume of gas under pressure within a capsule located within a sealed container having liquid therein containing dissolved gases and a headspace containing gas under greater than atmospheric pressure comprises the steps of, causing liquid to enter the capsule and thereby alter the buoyancy and stability thereof and result in a rotation of the capsule so that an aperture through which liquid is entering the capsule rises above the surface of the liquid and a smaller aperture through which

gas is to jet when the can is opened is caused to rotate below the level of the liquid within the container.

According to another aspect of the invention in a method as aforesaid, the volume of liquid entering the capsule is arranged to alter the buoyancy thereof to such an extent that the capsule sinks within the liquid either before, after or during inversion so that the device is situated at or near the bottom of the container at the time when the can is broached and the headspace pressure relieved.

A key advantage of devices such as aforesaid is the ease with which such capsules can be separated from the bulk and handled at high speed. This is particularly the case where regular shapes and smooth external surfaces such as spherical shapes are involved. This makes the devices particularly suitable for insertion into containers at high speed immediately after filling.

Bulk spherical devices behave in a similar way to non-viscous fluids making the process particularly attractive for canning applications since the handling technology becomes broadly similar to that of handling liquids.

In a canning plant, capsules waiting to be inserted into cans are preferably maintained in an inert atmosphere typically nitrogen preferably under pressure greater than atmospheric so that the capsules are oxygen free when delivered to the cans so that there is the minimum of oxygen present in the can after sealing to cause unwanted oxidation of beverage in the can.

The invention will now be described by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a cross-sectional view through a can containing a capsule constructed in accordance with the invention;

Figure 2 is a similar view in which the capsule has inverted and sunk;

Figure 3 is similar to Figure 1 and shows a modified capsule;

Figure 4 shows the modified capsule inverted and sunk;

Figure 5 is a diagrammatic plan view illustrating how a can filling carousel can be followed by a capsule inserting carousel;

Figure 6 illustrates how spherical capsules can be handled prior to insertion into cans;

Figure 7 shows how spherical capsules can be aligned and fed to cans on a filling line; and

Figure 8 is a perspective diagrammatic view of a can filling line incorporating the arrangements of Figures 6 and 7.

In Figure 1 a sealed container 10 contains beer 12 having nitrogen and carbon dioxide gas dissolved therein. In known manner the can 10 is pressurised so that the headspace 14 contains nitrogen and carbon dioxide.

Floating in the beer is a generally spherical capsule 16 the interior of which is hollow and contains an upstanding tube 18 which communicates through its open upper end 20 with the interior of the capsule and at its lower end through a passage 22 with the beer 12. A second much smaller aperture 24 is located generally diametrically opposite the passage 22 but not in alignment with the open end 20 of the tube 18.

Situated around the tube is an annular ballast weight 26. This is situated so that its centre of mass is located below the centre of area of the capsule 16 and by making the capsule and tube from very low density material and selecting a high density material for the ballast ring 26, the latter will largely

influence the buoyancy and orientation of the capsule 16 when floating in the liquid.

By locating the ballast ring 26 just below the centre of area of the capsule 16, the latter will tend to float in the orientation shown in Figure 1 and the depth at which the capsule floats will be determined by the weight of the ring 26 and this is selected so that when initially dropped into the can, the capsule will tend to float in the position shown in Figure 1 with the aperture 26 just above the surface.

The size of the aperture 24 is typically in the range 130300 microns.

As the headspace pressure 14 builds up during pressurisation of the sealed can 10 (typically by way of nitrogen dosing during the canning process), the interior of the capsule 16 will rise to the same pressure of headspace 14 by virtue of the communication between the capsule and the headspace through the aperture 24.

The tube 18 is filled with a porous material 28 and the latter also fills the upper region of the spherical interior of the capsule in the form of a mushroom as at 30. A space is left around the interior surface below the aperture 24 so that the latter can communicate with the lower part of the interior of the capsule as denoted by reference numeral 32. The porous material 28, 30 serves as a wick and beer is drawn by the wick into the tube 18 through the passage 22 causing the wick 28 to become saturated with the beer. Eventually the weight of the liquid within the wick in combination with the weight 26 is sufficient to cause the capsule 16 to lose buoyancy and sink .

Continued ingress of liquid via the wick into the material 30 located in the upper region of the capsule eventually causes the centre of gravity of the capsule to shift above the centre of area of the capsule 16 so that the capsule is now in a condition of unstable equilibrium and the slightest influence will tend to

cause the capsule 16 to rotate so that the centre of gravity is now below the centre area of the capsule 16.

The new orientation is shown in Figure 2. Here the aperture 24 is now at the bottom and the passage 22 at the top.

Although there is communication between the gas trapped in the space 32 via the aperture 24 and the liquid 12 in the container 10, there is little tendency for gas to escape and be replaced by liquid due to the configuration of the arrangement and since the liquid in the wick material 28 and 30 provides a liquid lock at the base of the tube 18, the gas trapped in the space 32 tends to remain in place.

Since the interior of the can 10 is pressurised in known manner, the gas in the space 32 within the capsule will be at the same pressure as the rest of the can typically 3 or 4 atmospheres in the case of carbonated and nitrogenated beer.

The contents of the can can be poured out by creating an opening in the lid of the can typically by deforming inwardly a defined flap 13 leaving an aperture in the lid through which the contents can be poured. Immediately this aperture is formed, the pressure of the headspace 14 drops to atmospheric and the gas in the space 32 in the capsule will attempt to leave the capsule to balance the pressure within the capsule to atmospheric pressure by leaving the capsule through the small hole 24 as a stream of fine bubbles. In this way an avalanche of small bubbles is formed as the jet of bubbles causes more gas in solution within the liquid to form and rise to the surface thus producing the desired head on the surface of the liquid.

Figures 3 and 4 are similar to Figures 1 and 2 except that here an additional tube 34 is shown communicating with the small aperture 24 so that the latter only communicates with the gaseous content of the interior of the spherical capsule particularly when the latter is orientated as shown in Figure 4 after it has

become submerged.

In all other regards the capsule shown in Figures 3 and 4 is constructed and operates in the same way as previously described with reference to Figures 1 and 2.

In the diagrammatic plan view of Figure 5 containers exiting a filler carousel 40 along line 42 pass directly into a second carousel 44 where capsules are inserted into the containers. These leave carousel 44 on path 46 to a seamer (not shown) where the can is dosed with liquid nitrogen and the lid is affixed and sealed in place.

Figure 6 illustrates how a capsule filling carousel such as 44 can be fed with spherical capsules.

A purge chamber 48 is supplied with assembled spherical capsules. When filled, the purge chamber is sealed and evacuated using a vacuum pump 50. After evacuation, the chamber is filled with nitrogen from a suitable supply along line 52 so that the capsules are now in a nitrogen environment and the interiors will be filled with nitrogen.

The contents of the purge chamber 48 can be transferred to a holding tank 54 when required so that a fresh purging process can be carried out on a fresh batch of capsules.

The holding tank 54 is supplied with nitrogen at a pressure slightly in excess of atmospheric and periodically capsules in the holding tank are transferred to the filler dispenser 56 by lowering a bell valve 58. A similar device (bell valve) is used for transferring capsules between the purge chamber and the holding tank.

Capsules in the filler dispenser 56 are maintained in a nitrogen atmosphere thereby preserving atmospheric integrity and from the filler dispenser 56 are allowed to roll into radially positioned

escapement shoots 60 and 62 to be deposited into cans such as 64 and 66. The latter are supported on a lifting table 68. During the filling cycle the system is configured to carry out further purging of the container headspace as by evacuation, purging with nitrogen and liquid nitrogen dosing.

An alternative arrangement is shown in Figure 7 in which purged capsules from stock such as the filler dispenser 56 of Figure 6, are supplied via a feed line 70 to an auger feed generally designated 72. The auger rotates about the axis 74 and the pitch of the auger varies along the axial length of the feed so that capsules such as 76 are captured by the auger and separated and spaced apart with movement along the table 78 until they reach the drop-off point 80. The latter is situated above a conveyor 82 on which cans are located and the conveyor and line of cans moves in the direction of the arrow 84 and is synchronised with the movement of the auger feed 72 so that capsules arrive at the drop-off point in synchronism with the arrival of the next empty can below the drop-off point 80. Thus capsule 86 is shown just about to drop into can 88.

By synchronising the movement, the next capsule 90 will arrive at the drop-off point 80 when can 92 arrives below the point 80. In this way capsules are separated and fed individually to the cans.

Each of the cans has previously been filled with beverage and the level of the beverage in the cans is denoted by reference numeral 94. As shown with reference to can 96, the capsule 98 floats in the beverage with the majority of the capsule below the level of the surface such as is shown in Figures 1 and 3.

The conveyor 82 moves the line of cans towards the seamer where just prior to the lid being applied to the can, the can is dosed with liquid nitrogen in known manner and thereafter sealed so that the process of gaseous priming of the capsule 98 can be performed as previously described.

Figure 8 illustrates a fully integrated on-line insertion plant. Here the cans are supplied along a conveyor path 100 to a filling carousel 102. Filled cans are supplied to the capsule loading auger 104 fed from the feed hopper 106. A bell valve 108 releases capsules into the hopper 106 from a purge chamber 110 itself fed from a hopper 112.

Capsules supplied to the auger 104 are transferred individually into the cans in the manner previously described in relation to Figure 7 and the cans are immediately transferred to the seamer (not shown).

A perspective overview of the complete system showing where the capsule insertion stage would be located is shown in Figure 8a.

Also shown in Figure 8 is the vacuum pump 114 for evacuating the purge chamber 110 via pipe 116. Not shown is the nitrogen input to the purge chamber and feed hopper.

Also now shown is shrouding around the auger 104 so that the auger filling stage can itself be operated in a nitrogen envelope to further maintain the integrity of the purged capsules so that there is little chance of any oxygen entering the capsule and thereby entering the cans.

The headspace is purged in the normal way which may involve evacuation, nitrogen blanketing, nitrogen dosing and the like prior to seaming.

Claims

1. A head device for generating a head on a beverage in a sealed container, when the container is opened, comprising a substantially hollow capsule having a first aperture, a second aperture remote from the first aperture, ballast means within the device selected as regards mass and position therein such that the capsule will float in a liquid with the first aperture above the liquid surface and the other immersed, wherein liquid can enter the capsule through the immersed aperture, the mass of liquid entering the capsule combining with the ballast to cause the capsule to rotate at least to the extent that the respective conditions of the two apertures are reversed and the interior of the capsule forming with the liquid therein a liquid lock when the latter is rotated to inhibit the further ingress of liquid and trap a volume of gas therein, and wherein the capsule contains absorbent material forming a wick which draws liquid up when the capsule is floating in liquid so as to alter the position of the centre of gravity of the capsule and cause the latter to assume a position of unstable equilibrium from which the capsule is readily rotatable so as to reverse the condition of the two apertures.

2. A device according to Claim 1, including valve means to create the said liquid lock and prevent gas from escaping in use except through the first aperture, when the sealed can is opened.

3. A device according to claim 2, wherein the valve means is operable by rotation of the capsule.

4. A device according to claim 2, wherein the valve means is operable by the entry of liquid into the capsule.

5. A device according to any of claims 1 to 4, wherein the ballast means is fixed in position within the capsule.

6. A device according to any of the claims 1 to 4, wherein the ballast means is upwardly movable relative to the capsule as a consequence of the ingress of liquid.

7. A device according to any of claims 1 to 6, wherein the second aperture communicates with the interior of the capsule by means of an elongate open ended tube which extends across the capsule to a position therein which is close to but spaced from a region of the inside surface of the capsule which is diametrically opposite the position of the said second aperture.

8. A device according to claim 7, wherein the first aperture is situated in a region of the capsule wall which is close to but not aligned with the open end of the said elongate tube.

9. A device according to claim 7 or claim 8, wherein the absorbent material is packed into the tube.

10. A device according to claim 9, wherein the first aperture communicates directly with the interior of the capsule and is not impeded by the liquid absorbent material therein.

11. A device according to claim 9 or claim 10, wherein a pipe extends from the said first aperture internally of the capsule generally parallel to the tube extending from the said second aperture, the length of the pipe associated with the said first aperture being selected so that when the capsule is rotated and the said first aperture is on the underside of the capsule, the other end of the pipe communicating with the said first aperture is situated in a region of the capsule which contains gas and is above the level of any liquid contained in the capsule as a result of ingress of liquid when liquid is drawn into the capsule by means of the wick.

12. A device according to any of claims 1 to 11, wherein the size of the first aperture is in the range 150-300 microns diameter.

13. A device according to claim 7 or any claim appendent thereto, wherein the ballast comprises an annular weight fitted around the tube which extends from the said second aperture into the capsule and is positioned therealong and has a mass such that the capsule will settle with the first aperture positioned above the surface of the liquid.

14. A device according to any of claims 1 to 13, wherein the capsule is spherical.

15. A device according to any of claims 1 to 13, wherein the shape of the capsule is selected to maximise bi-stability as between one orientation of the capsule and the other.

16. A device according to claim 2 or any claim appendent thereto, wherein the valve means is operable by a timing device or by a temperature sensitive device or by a magnetic field or by relative movement between a flotation member and the capsule wall.

17. A device according to claim 6 or any claim appendent thereto, wherein the ballast means is a bouyant member which rises with the rising level of liquid within the capsule so as to raise the centre of gravity of the capsule and create an unstable condition and cause the capsule to invert into a position of stability.

18. A device according to claim 3 or any claim appendent thereto, wherein one way valves are located in the apertures in the capsule and the capsule is weighted to float in a particular orientation with the upper one way valve mechanism allowing flow of gas from the headspace into the device and the lower valve permitting positive pressure inside the device to vent through the submerged hole.

19. A device according to any of claims 1 to 18, when located within a sealed and pressurised container which is partially

filled with liquid in such a manner that the interior of the capsule is pressurised by the gas in the headspace above the liquid to the same elevated pressure as that of the headspace and, after the capsule rotates, the trapped gas remains at the elevated pressure and is available to issue from the capsule when the container is opened and the pressure in the container drops.

20. A device according to claim 19, when located in a sealed and pressurised container partially filled with liquid containing dissolved gas such as nitrogen and carbon dioxide and when the container is opened, the issuing gas has to pass through the liquid before it can escape to atmosphere, the issuing device being arranged so that the gas initiates an avalanche effect on the dissolved gases and create a head of fine bubbles on the liquid.

21. A device according to claim 20, wherein the size of the aperture through which the gas is to issue into the liquid is selected so as to create such a fine jet.

22. A sealed container partially filled with a liquid having gas dissolved therein and a headspace above the apertures in the liquid containing gas at a pressure greater than atmospheric, and located within the said container a head generating device as claimed in any of claims 1 to 18, so that when the end of the container adjacent the headspace is broached as by severing a weakened tab region and the headspace pressure is relieved to atmosphere the trapped high pressure gas within the capsule will be jetted into the liquid to assist in the generation of an upward avalanche of small bubbles to form a head on the surface of the liquid when the latter is poured into a glass or other drinking vessel.

23. A method of trapping a volume of gas under pressure within a capsule located within a sealed container having liquid therein containing dissolved gases and a headspace containing gas under greater than atmospheric pressure comprising the steps of,

causing liquid to enter the capsule and thereby alter the buoyancy and stability thereof and result in a rotation of the capsule so that an aperture through which liquid is entering the capsule rises above the surface of the liquid and a smaller aperture through which gas is to jet below the level of the liquid within the container, when the can is opened.

24. A method according to claim 23, wherein the volume of liquid entering the capsule is arranged to alter the buoyancy thereof to such an extent that the capsule sinks within the liquid either before, after or during at least partial inversion so that the device is situated at or near the bottom of the container at the time when the can is broached and the headspace pressure relieved.

25. A method according to claim 23 or claim 24 wherein, by appropriate selection of position and/or direction of jet, the exiting gas from the capsule causes the latter to rotate within the container, thus expelling of gas around the whole of the cross-sectional area of the liquid in the container.

26. Apparatus for canning beverages in sealed containers incorporating filled generating devices as claimed in any of claims 1 to 22, wherein capsules waiting to be inserted into containers are maintained in an inert nitrogen atmosphere greater than atmospheric pressure and said inert atmosphere is maintained on a canning line up to the point of insertion of the capsules into containers which are sealed with nitrogen under pressure.

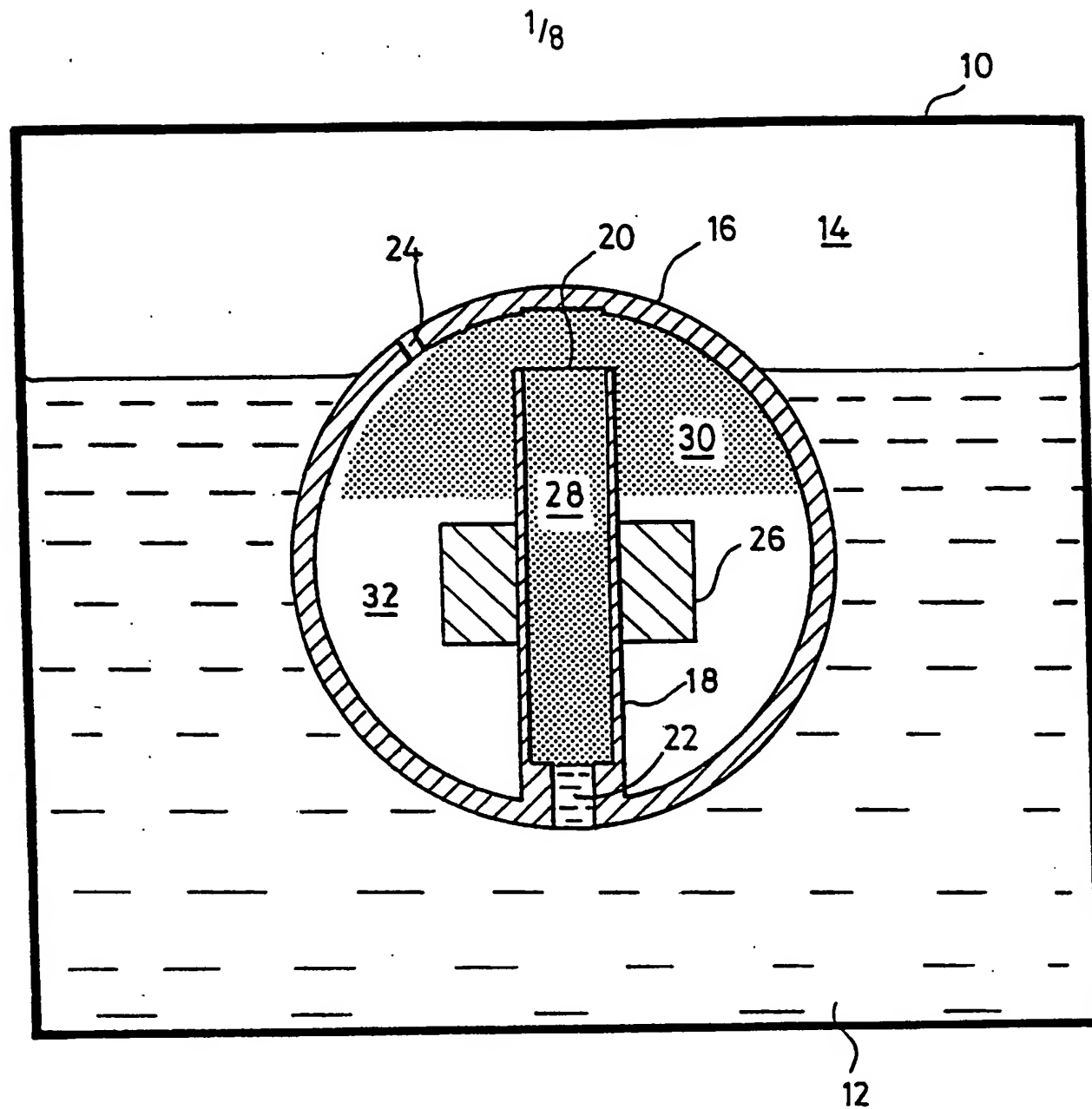
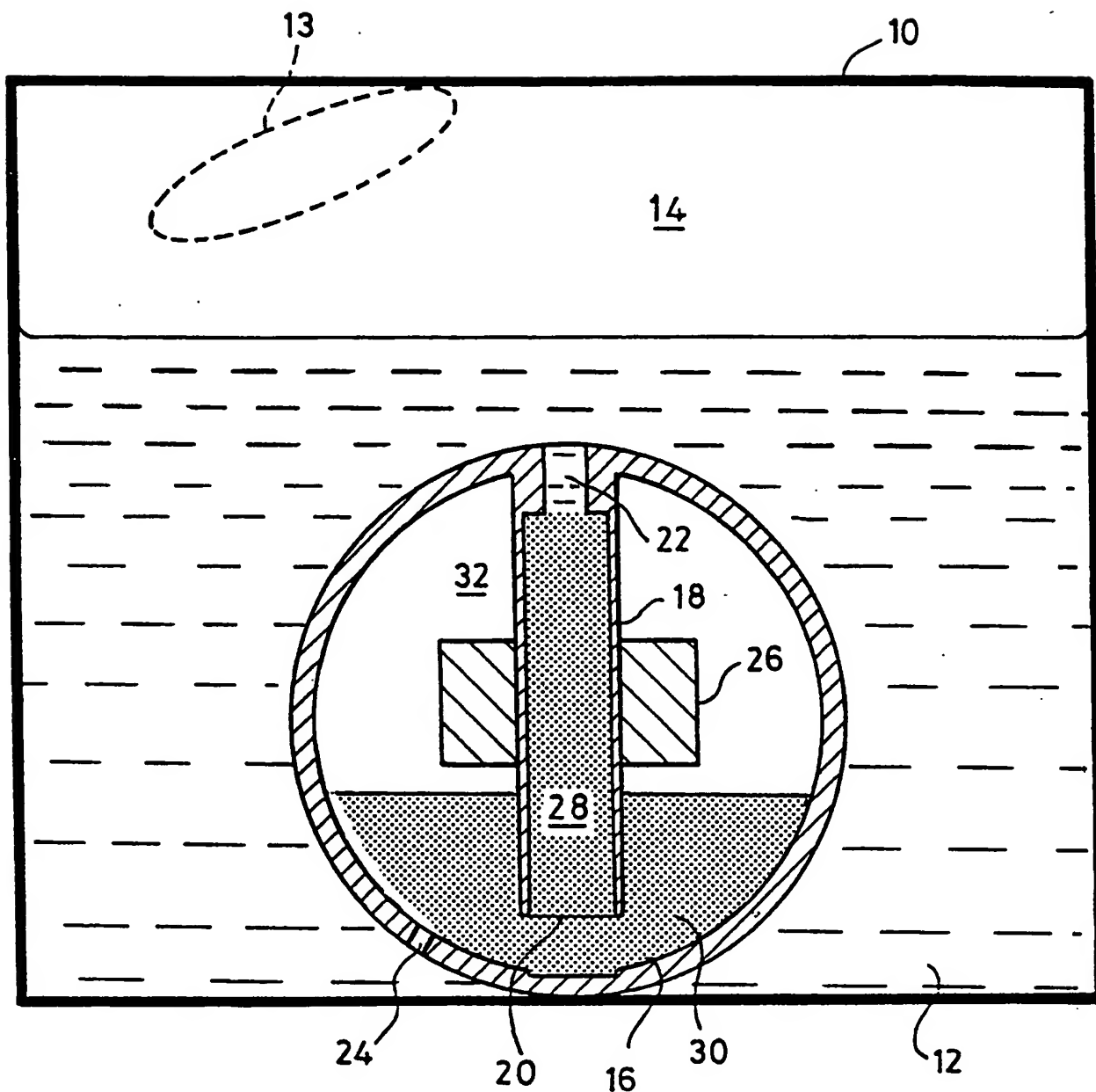


Fig. 1

2/8

**Fig. 2**

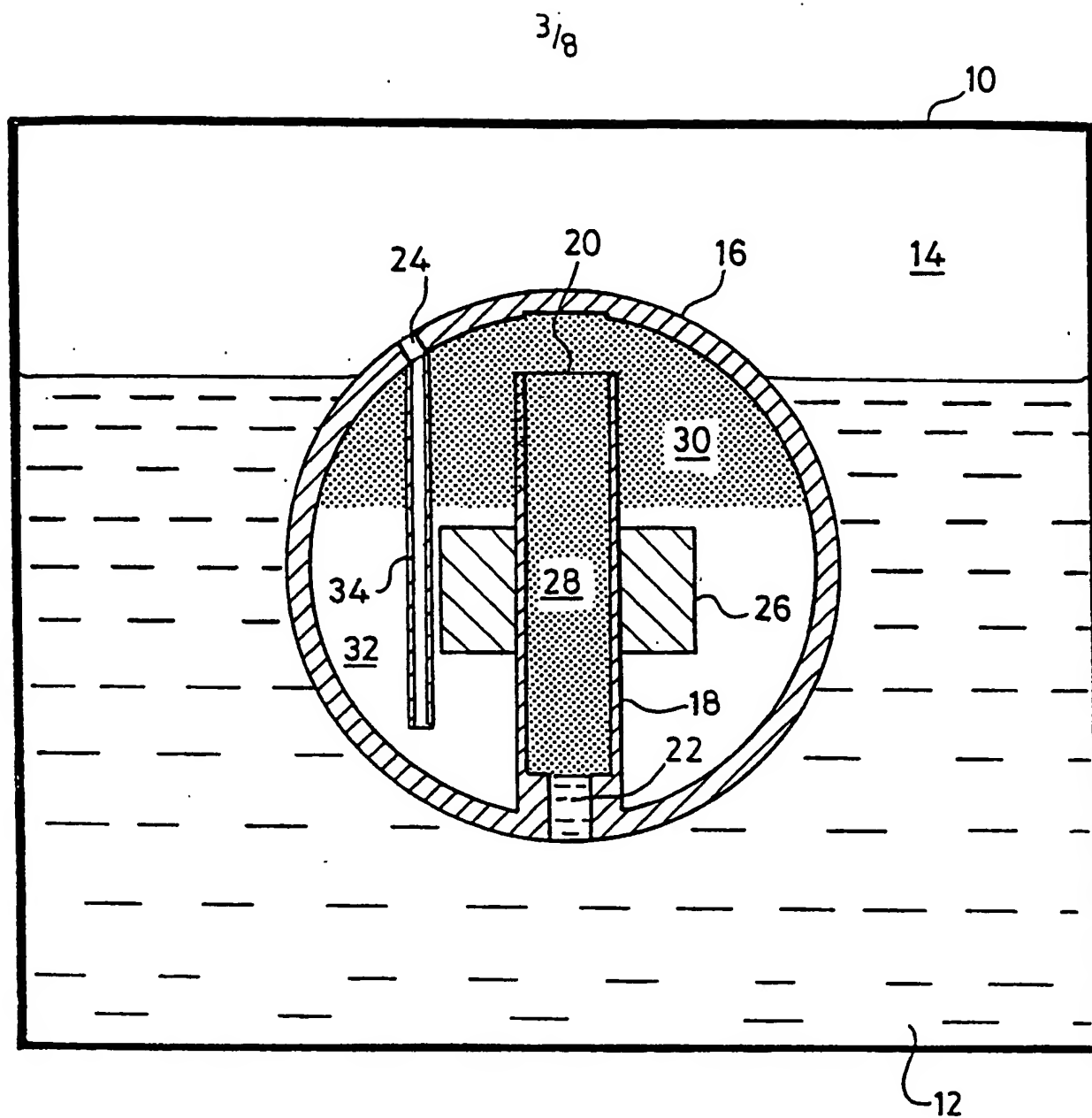
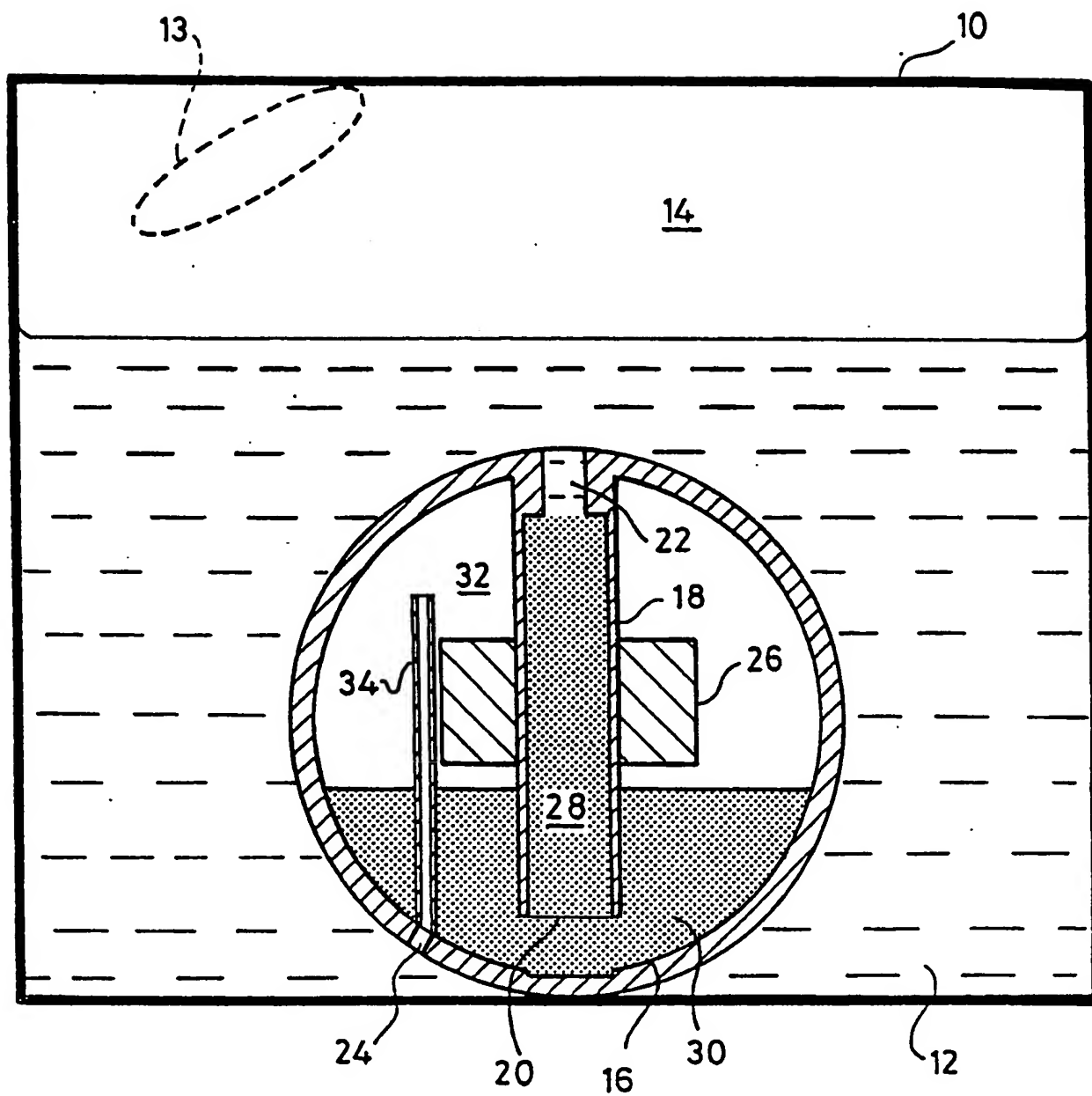
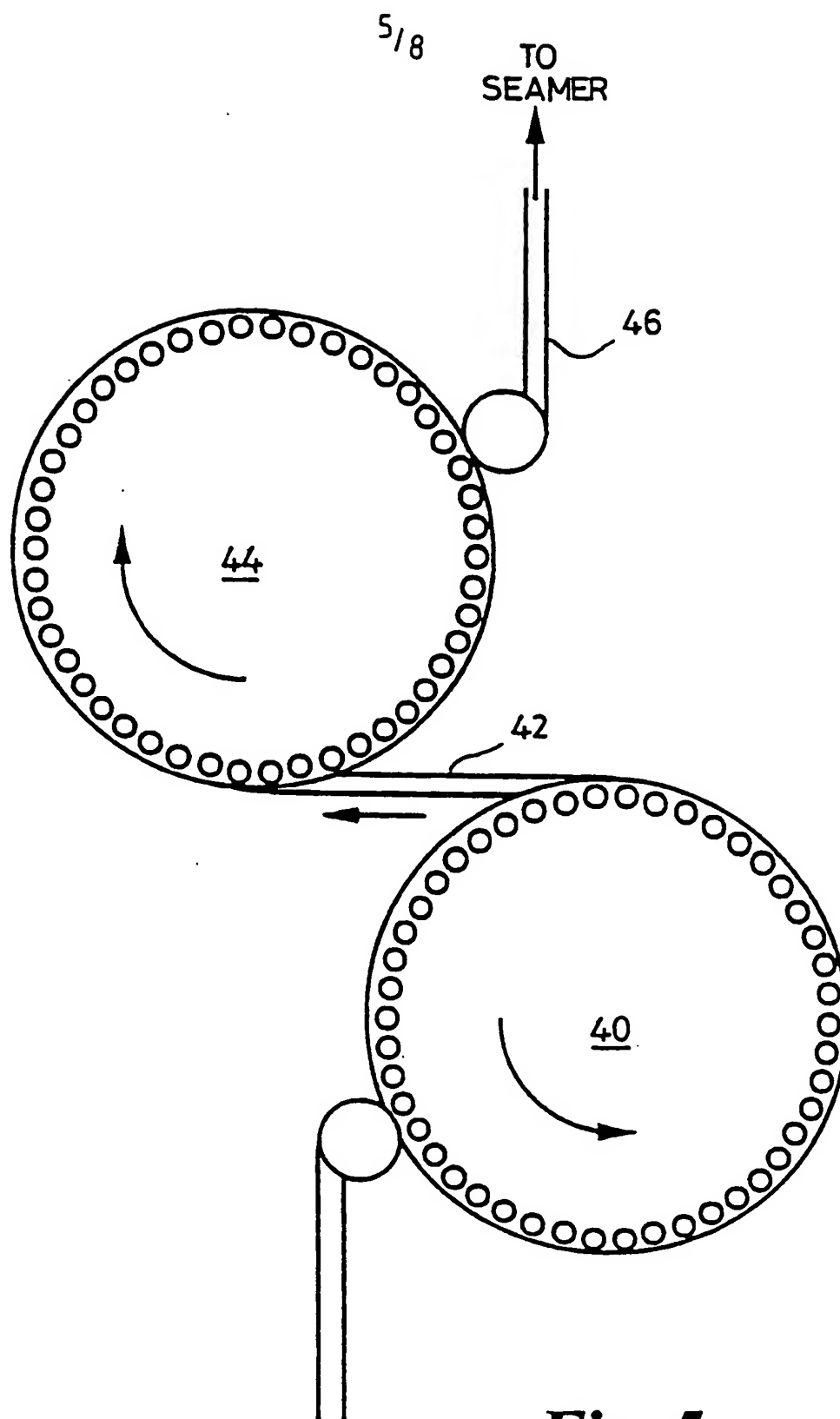
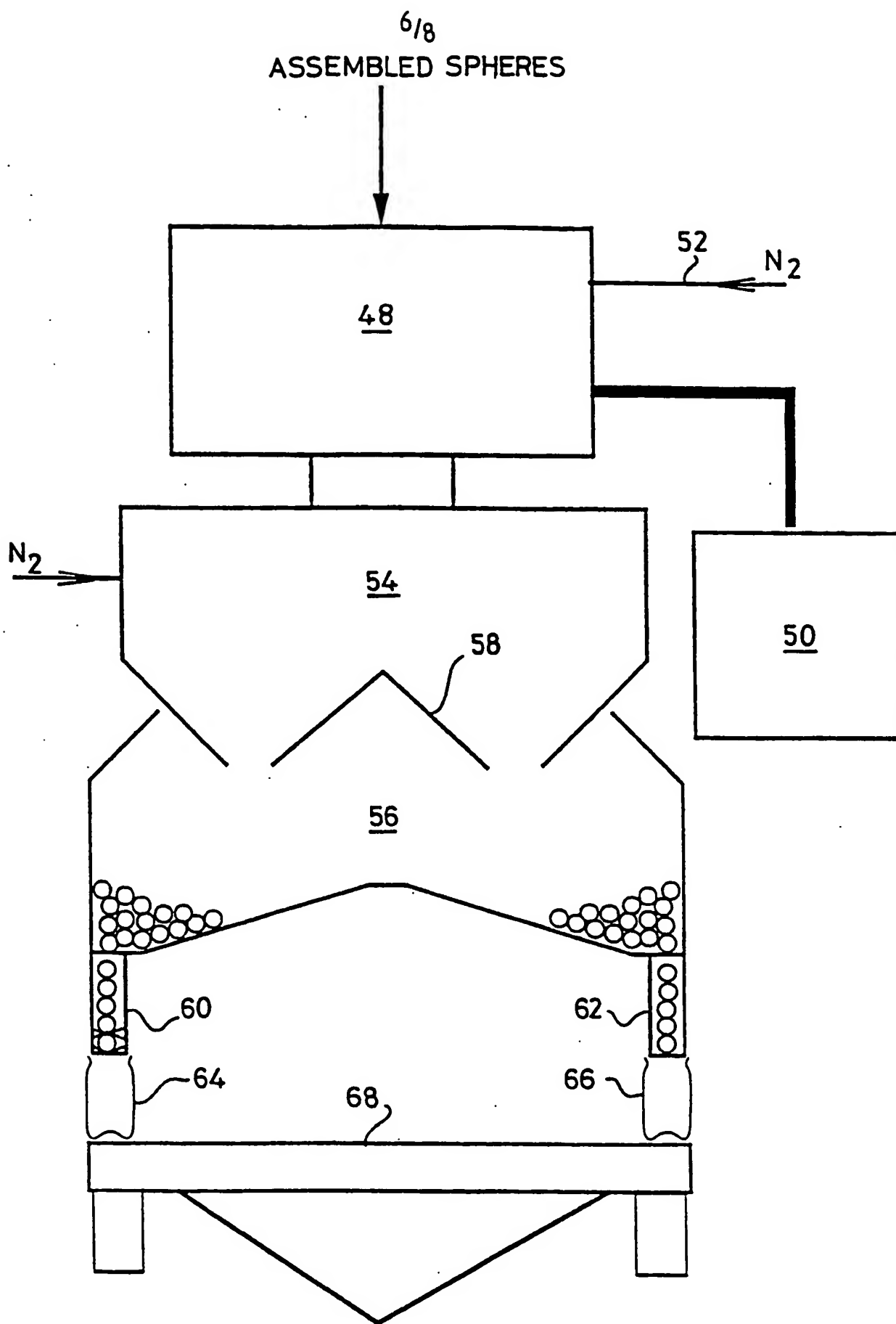


Fig. 3

4/8

**Fig. 4**

**Fig. 5**

*Fig. 6*

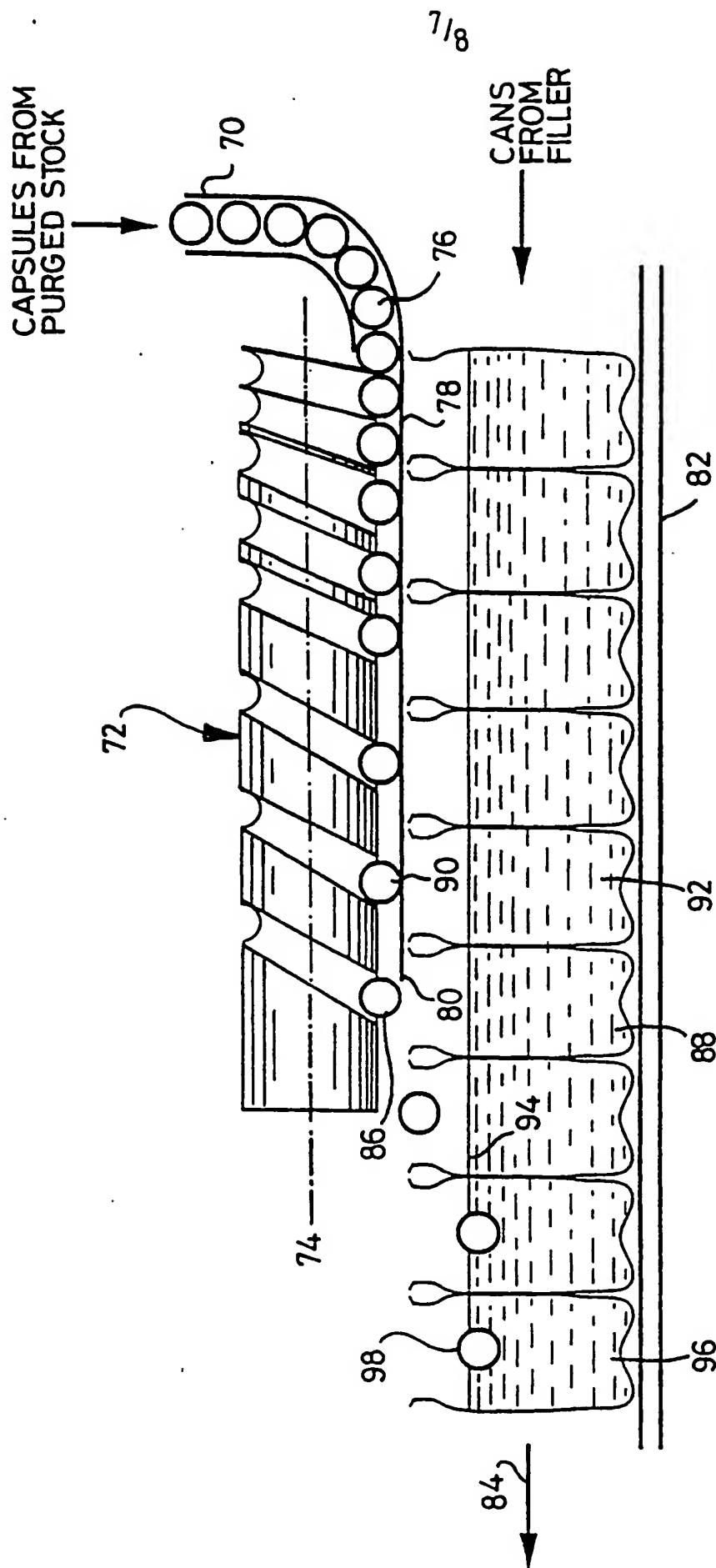
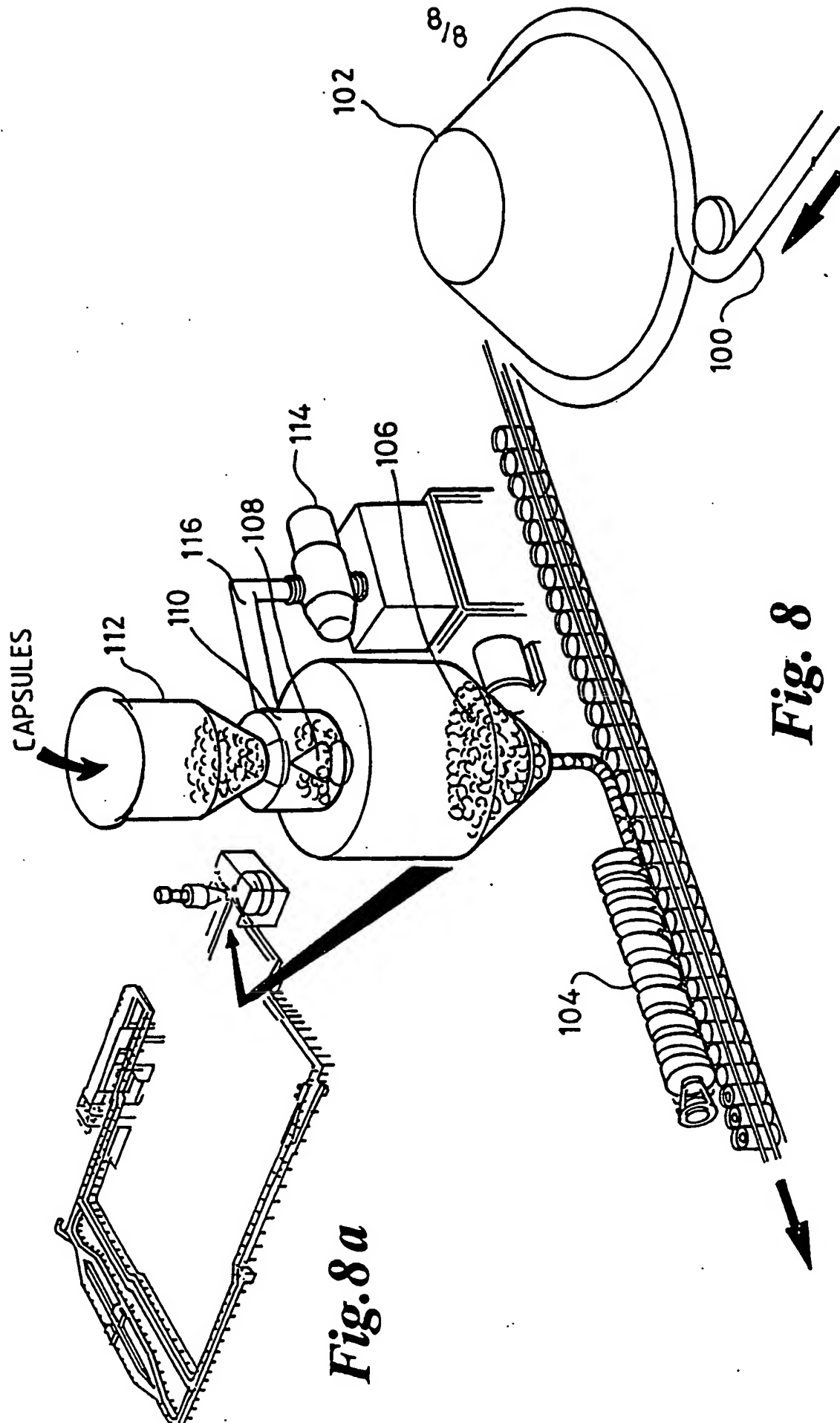


Fig. 7



**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.